

Brief Report

Neuropsychological Functioning in Specific Learning Disorders - Reading, Writing and Mixed Groups

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ABSTRACT

Aim: The study compared the pattern of deficits, intelligence and neuropsychological functioning in subcategories of learning disorders.

Methods: Forty-six children (16 with reading disorders, 11 with writing disorders and 19 with both reading and writing disorders - mixed group) in the age range of 7–14 years were assessed using the NIMHANS Index of Specific Learning Disabilities, Malin's Intelligence Scale for Indian Children, and the PGI Memory Scale.

Results: The mixed group had greater dysfunction than the reading and writing groups in alphabet sequencing and graded division, and the mixed group had greater dysfunction than the writing group in capital letters, division and graded subtraction. Also, the mixed and reading groups had greater dysfunction than the writing group in speech and language. Intellectual functions and mental balance (on PGI memory scale) were more affected in the mixed group in comparison to the writing group.

Conclusion: Subtypes of learning disorders differ in terms of their neuropsychological profile with the mixed group having greater dysfunction.

Key words: Reading, Writing, Neuropsychological assessment

INTRODUCTION

Learning disorders or specific developmental disorders of scholastic skills are characterized by significant impairments in acquisition of reading, spelling or arithmetical skills. They are not due to lack of opportunity to learn or a consequence of brain trauma or disease, but represent a specific type of dysfunction in cognitive processing. This dysfunction affects specific skills, which can be distinguished from the cognitive functions that are usually in the normal range. More children are being identified as having specific difficulties which hinder their learning than ever before.¹⁻² Previous studies show that subgroups of children with SLD may have difficulties with speed of processing information, short-term/ working memory, and auditory processing than other children of the same age.³

There is a need to understand both the distinctive aspects of and the considerable overlap between each specific learning disorder (SLD) as they may have different underlying

mechanisms. The aim of the study was to compare the pattern of deficits, intelligence and neuropsychological functioning in subcategories of learning disorders. Preliminary work on the nature of the disorder and its neuropsychological profile has been reported elsewhere.⁴

METHODOLOGY

Forty-six children attending the Child and Adolescent Psychiatric Clinic at the Postgraduate Institute of Medical Education and Research, Chandigarh and diagnosed as having SLD according to ICD-10 descriptions were included in the study. These children were of either gender and were between 7 to 14 years of age. They were studying in English medium schools. Children with head injury, trauma or infection, epilepsy or an IQ less than 70 were excluded from the study. The sample consisted of 16 children with reading disorders, 11 with writing disorders and 19 with both reading and writing disorders.

After a written informed consent was obtained from the parents, the children were administered the following tests in 2 sessions: The NIMHANS Index of Specific Learning Disabilities,⁵ the Malin's Intelligence Scale for Indian children (MISIC),⁶ and the Postgraduate Institute (PGI) Memory Scale for Children.⁷ The NIMHANS Index of SLD comprises test on attention, language, arithmetic, visual-motor skills and memory. Both, Level I (for children aged 5–7 years) and level II (for children aged 8–12 years) were used in the present study. Only six subtests of the MISIC were used. The PGI Memory Scale for Children (designed for 7–14 year olds) consists of 10 subtests: remote memory, recent memory, mental balance, attention and concentration, delayed recall, immediate recall, verbal retention for similar pairs, verbal retention for dissimilar pairs, visual retention and recognition of common objects.

The three groups were compared using analysis of variance (ANOVA) and post-hoc 2 by 2 Scheffe's Test.

RESULTS

The mean age of the writing, reading and mixed group was 10.81 years (SD 2.23), 11.86 years (SD 2.45), 10.45 years (SD 2.61) respectively. The mean years of education were 5.25 years (SD 2.35), 6.82 years (SD 2.36), 4.89 years (SD 2.16) respectively. The fathers and mothers of the children had received between 12-15 years of education.

Table 1: Comparison of writing, reading and mixed sub-groups on selected variables

	Writing (1) Mean (SD)	Reading (2) Mean (SD)	Mixed (3) Mean (SD)	F, p (df=3, 40, 43)	Post Hoc 2X2 Scheffe's test
NIMHANS Index of Specific Learning Disabilities					
Visual Memory	1.06 (1.06)	.90 (1.70)	2.10 (1.37)	3.72*	
Speech & Language^s	9.68 (3.75)	6.27 (2.72)	5.26 (2.13)	10.45**	1>2, 3
Spelling	5.50 (3.52)	5.09 (4.13)	8.42 (3.77)	3.76*	
Capital Letters	.75 (1.57)	.00 (.00)	2.4 (3.07)	5.13*	3>2
Alphabet sequencing	.06 (.25)	.00 (.00)	2.0 (2.36)	9.56**	3>1,2
Multiplication	.50 (1.26)	.18 (.40)	1.47 (1.83)	3.54*	
Division	.68 (1.70)	.00 (.00)	1.73 (2.18)	3.79*	3>2
Graded Subtraction	1.25 (1.91)	.09 (.30)	2.10 (2.13)	4.43*	3>2
Graded Division	1.50 (1.89)	1.54 (1.12)	3.36 (1.92)	6.16**	3>1,2
LC: Right Responses	122.3 (4.61)	123.18 (1.99)	118.31 (6.42)	4.32*	
LC: Wrong Responses	.06 (.250)	1.45 (3.26)	.00 (.00)	3.40*	
LC: Omissions	3.25 (3.66)	2.18 (2.04)	6.52 (6.93)	3.12*	

MISIC

Verbal Quotient	104.87 (11.98)	94.77 (6.68)	90.84 (11.31)	7.72**	1>3
Performance Quotient	105.06 (16.63)	96.40 (11.08)	90.94 (10.86)	4.98*	1>3
Intelligence Quotient	105.06 (12.62)	95.00 (7.44)	91.44 (9.71)	7.73**	1>3
PGI Memory Scale for Children					
Mental Balance	9.37 (2.39)	9.27 (0.90)	6.57 (2.58)	8.48**	1, 2>3
Retention of Similar Pairs	4.50 (0.63)	4.63 (0.67)	3.89 (1.04)	3.53*	

LC: Letter Cancellation⁸ Positive score, * $p < .05$, ** $p < .01$

As is evident from Table 1, the three groups had significantly different scores on visual memory ($F=3.72$, $df=3, 40, 43$, $p<0.05$), speech and language ($F=10.45$, $df=3, 40, 43$, $p<0.01$), spelling ($F=3.76$, $df=3, 40, 43$, $p<0.05$), capital letters ($F=5.13$, $df=3, 40, 43$, $p<0.05$), alphabet sequencing ($F=9.56$, $df=3, 40, 43$, $p<0.01$), multiplication ($F=3.54$, $df=3, 40, 43$, $p<0.05$), division ($F=3.79$, $df=3, 40, 43$, $p<0.05$), graded subtraction ($F=4.43$, $df=3, 40, 43$, $p<0.05$), graded division ($F=6.61$, $df=3, 40, 43$, $p<0.01$), LC Right responses ($F=4.42$, $df=3, 40, 43$, $p<0.05$), LC wrong responses ($F=3.40$, $df=3, 40, 43$, $p<0.05$) and omissions ($F=3.12$, $df=3, 40, 43$, $p<0.05$). On post-hoc 2X2 tests ($p<0.05$) the mixed group had greater dysfunction than the reading and writing groups in alphabet sequencing and graded division, and the mixed group had greater dysfunction than the writing group in capital letters, division and graded subtraction. Also, the mixed and reading groups had greater dysfunction than the writing group in speech and language.

Children in the three SLD subgroups differed from each other on 5 of the 6 subtests of MISIC that were administered: information ($F=4.71$, $df=3, 40, 43$, $p<0.05$), general comprehension ($F=10.97$, $df=3, 40, 43$, $p<0.01$), arithmetic ($F=6.62$, $df=3, 40, 43$, $p<0.01$), digit span ($F=3.21$, $df=3, 40, 43$, $p<0.05$), picture completion ($F=5.07$, $df=3, 40, 43$, $p<0.05$) and also in the verbal ($F=7.72$, $df=3, 40, 43$, $p<0.01$), performance ($F=4.98$, $df=3, 40, 43$, $p<0.05$) and overall intelligence ($F=7.73$, $df=3, 40, 43$, $p<0.01$) scores. Children in the writing disorder subgroup performed better than the children of the mixed subgroup on all these parameters and better than the reading disorder subgroup on general comprehension subtest. There were significant differences between three groups on mental balance ($F=8.48$, $df=3, 40, 43$, $p<0.01$) and retention of similar pairs ($F=3.53$, $df=3, 40, 43$, $p<0.01$). Mental balance was significantly more impaired in the mixed subgroup than in the writing and reading subgroups.

DISCUSSION

Specific learning disorder of reading and writing seem to have a language based disorder, resulting in difficulty in spelling, grammar, punctuation, capitalization and/or composition. The study shows that children with mixed disorder of reading-writing are more severely impaired than children with specific disorders of reading or writing in alphabet sequencing and graded division. Sequencing deficits are related to deficits in integration ability.

The finding that the mixed disorder group and reading disorder group had greater dysfunction in speech and language than the writing disorder group can be explained by two hypotheses. Firstly the same linguistic deficits that impede learning to read could impede learning to spell and write. Secondly slow progress in learning to read might deprive a child of knowledge about writing that is gained by reading. There must be an atomization of most of the

lower level mental activities for skilled writing, which guide handwriting, spelling, and choice of words and construction of sentences.

The findings of the study should be interpreted in the light of the limited sample size that may have resulted in type 2 errors (missing significant differences). Also, it should be remembered that all the three subgroups had difficulties in attention and concentration. These difficulties can pose hurdles in recall of previous experience and learning.

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